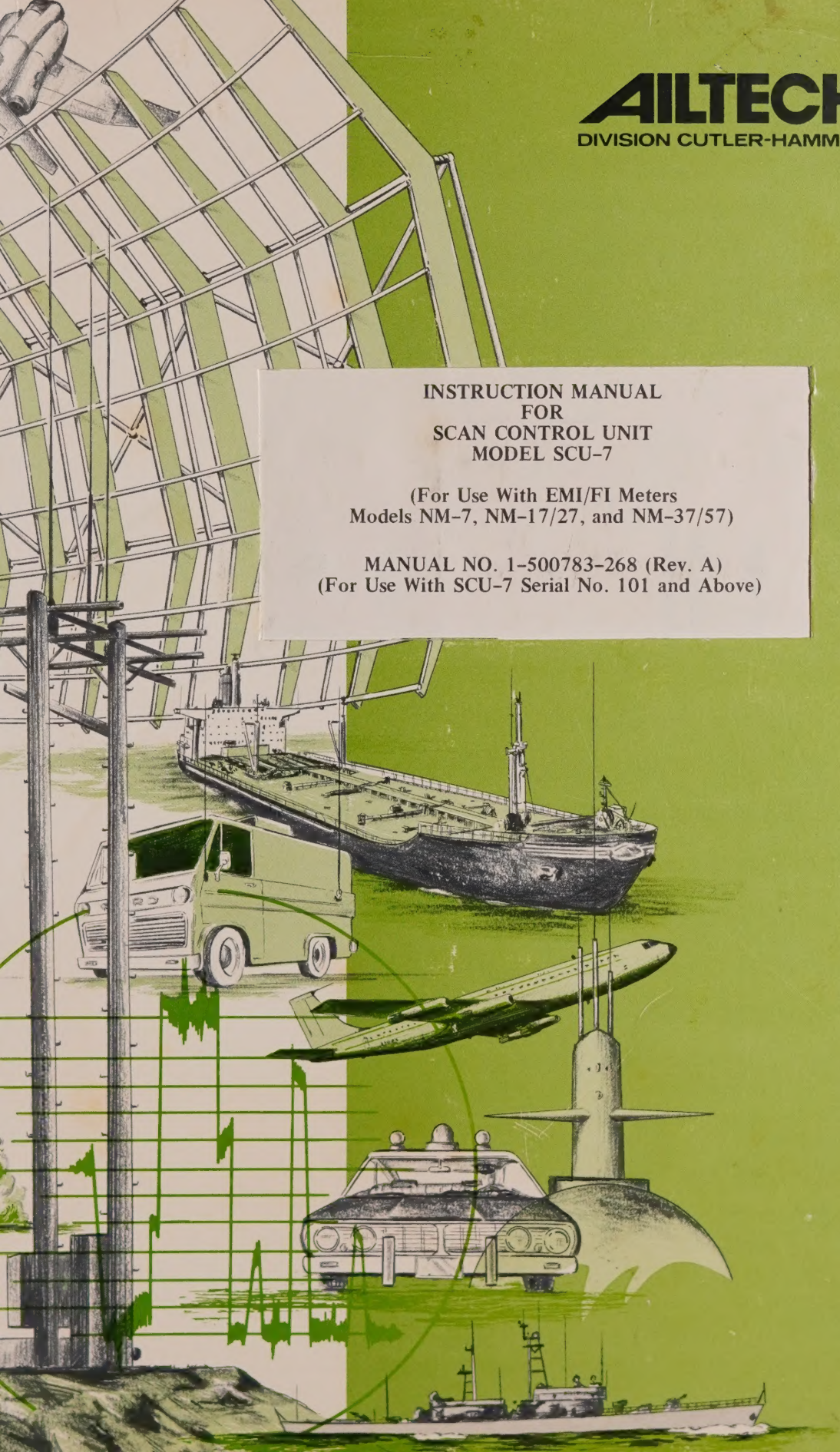
AILTECH
DIVISION CUTLER-HAMMER

INSTRUCTION MANUAL FOR SCAN CONTROL UNIT MODEL SCU-7

(For Use With EMI/FI Meters
Models NM-7, NM-17/27, and NM-37/57)

MANUAL NO. 1-500783-268 (Rev. A)
(For Use With SCU-7 Serial No. 101 and Above)



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2. Serial Number
3. Description of trouble(1)
4. Approximate date instrument was placed in operation.
5. Approximate number of hours in use.
6. Has maintenance action been previously requested.
7. Other comments.

(1) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken and any other relevant data.

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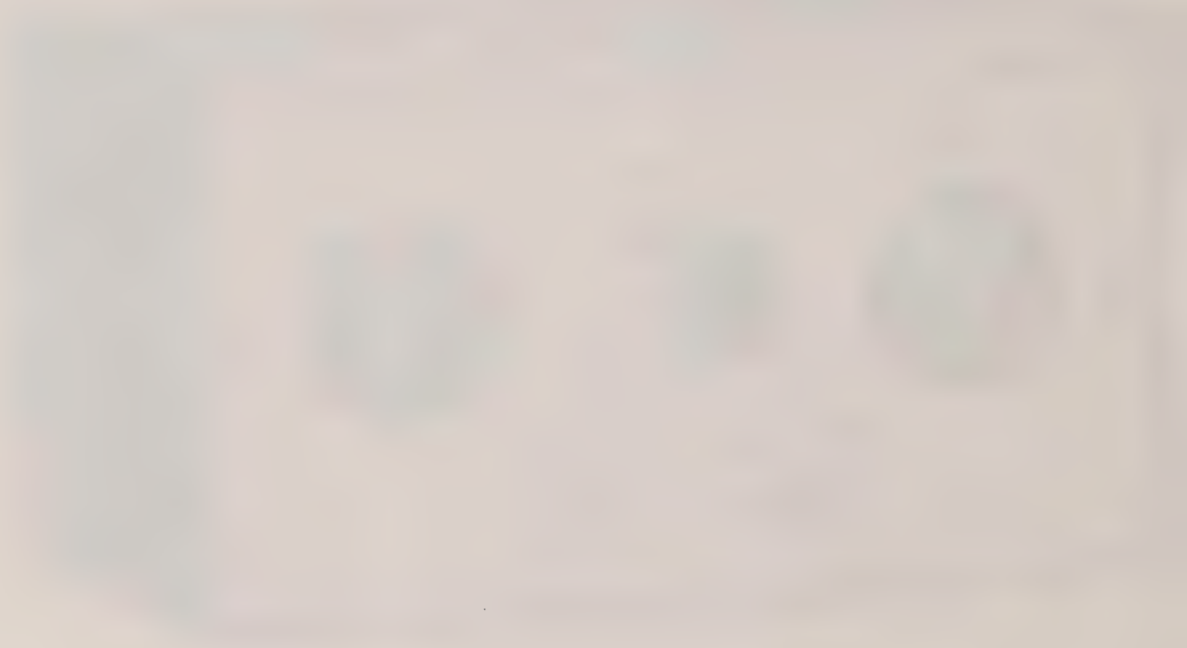
Figure 1-1. Scan Control Unit, Model SCU-7



Section I

INTRODUCTION

1.1 SCOPE OF MANUAL

This manual is designed to provide operation and maintenance information for the Scan Control Unit, Model SCU-7 (Figure 1-1). The manual is divided into eight sections containing an introduction, specifications and operating characteristics, installation, operating instructions, theory of operation, maintenance, replaceable parts, and schematic diagrams. The abbreviations for units in this manual follow the IEEE "Standard Symbols for Units" (IEEE No. 260).

1.2 GENERAL DESCRIPTION

The Scan Control Unit, Model SCU-7, is a solid state device which is operated with a Singer Model NM-7, NM-17/27, NM-37/57 EMI/Field Intensity Meter. Its +12 Vdc and -12 Vdc operating voltages are supplied by the EMI/FI Meter from the AUX POWER receptacle.* It is designed to provide variable center frequency, variable scan width, and variable scan rate throughout any band of the EMI/FI Meter. There is a fast scan rate suitable to provide a spectral display on an oscilloscope and a slower scan time necessary for the operation of an X-Y plotter.

1.3 SUPPLIED ACCESSORIES

The items listed in Table 1-1 are furnished with the Model SCU-7.

*See Section III for availability.

Table 1-1. Supplied Accessories

Quantity	Device	Singer Model No. / Part No.
1	Instruction Manual	1-500783-268
1	Power cable	1-004862-001
1	Scan cable	94609-1
1	Pen lift cable	94610-1

1.4 RECOMMENDED ACCESSORIES

The items which follow are recommended for complete operation of the Model SCU-7, in addition to the supplied accessories listed in Table 1-1.

a. BNC to BNC cable, Model 94596-1, 6 ft (3 to 5 required depending on set-up).

b. Oscilloscope or X-Y plotter

c. BNC 75 ohm termination

d. BNC T adapter

Section II

SPECIFICATIONS AND OPERATING CHARACTERISTICS

2.1 SPECIFICATIONS AND OPERATING CHARACTERISTICS

Table 2-1 contains the specifications and operating characteristics for the Model SCU-7 Scan Control Unit.

Table 2-1. Specifications and Operating Characteristics

Parameter	Characteristics
Center frequency range (f_o)	0 to 100% of receiver band
Scan width range ($\triangle$ f)	0 to 100% of receiver band
Scan rate, Spectrum mode	Approximately 30 ms to 3 s per sweep (30 Hz to 0.3 Hz)
Plot mode	Approximately 15 s to 25 min per plot
X-Axis output level	Approximately 0 V to +10 V
Power requirements	+12 Vdc at approximately 40 mA -12 Vdc at approximately 40 mA
Warm-up time	"Instant on"
Pen lift contact rating	1 A peak (surge) max, 200 Vdc max
Mechanical	
Dimensions (including knobs and receptacles)	Approximate height: 9 cm (3.5") Approximate width: 13 cm (5") Approximate depth: 9.5 cm (4")
Weight	Approximately 1 kg (2 lbs, 2 oz)

Table 2-1. Specifications and Operating Characteristics, Continued

Parameter	Characteristics
Environmental	
Temperature	Operational: -15°C to +50°C (+5°F to +123°F) Non-operational: -50°C to +75°C (-58°F to +167°F)
Vibration	Meets MIL-T-21200, Class 3, non-operating
Altitude	Operational to at least 4570 m (15,000 ft) mean sea level

Section III

INSTALLATION

3.1 INSTALLATION PROCEDURE

3.1.1 Power Connections

Power is supplied to the Model SCU-7 from the EMI/FI Meter with which it is used by means of the supplied Power Cable, part number 1-004862-001.

NOTE

Early EMI/FI Meters did not have the AUX PWR receptacle. A Modification Kit, P/N 1-601119-002, is available to add this receptacle. If this is undesireable, the Power Cable may be modified to connect the Model SCU-7 to the EMI/FI Meter PROGRAMMER receptacle to obtain power as in the following:

Remove the connector from one end of the Power Cable and reconnect the cable to the 41 pin connector, P/N 1-910101-005, supplied with the EMI/FI Meter as in Table 3-1.

Table 3-1. Modified Power Cable Wiring

Voltage	6 Pin Connector Pin No.	41 Pin Connector Pin No.
+12 V	F	t
-12 V	B	s
GND	D	U

3.1.2 Plot Scan Mode Interconnections

a. Refer to Paragraph 3.1.1 for power connections. Refer also to Figure 3-1.

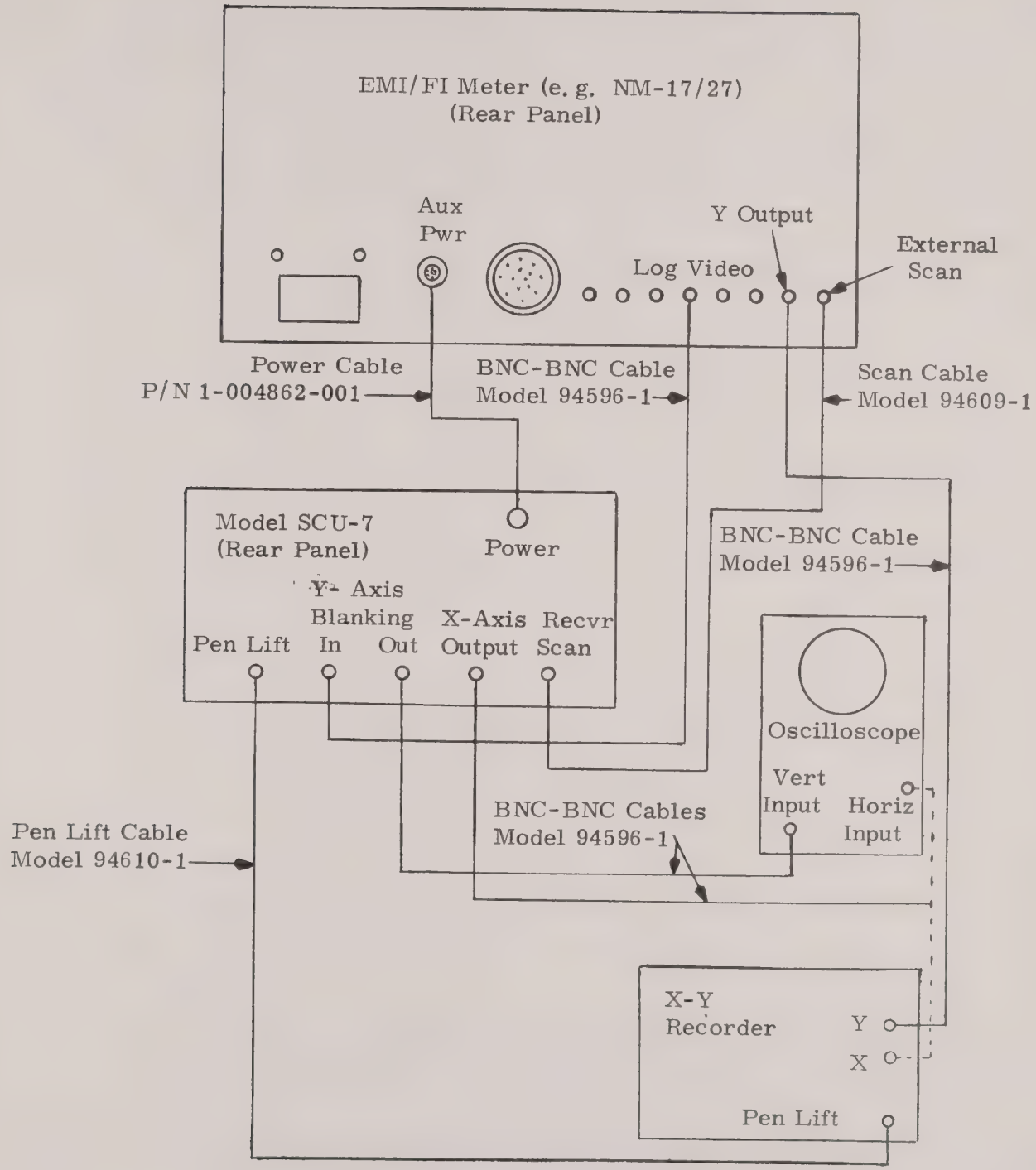


Figure 3-1. Model SCU-7 System Interconnection Diagram

b. Connect the EXTERNAL SCAN receptacle of the EMI/FI Meter to the RECEIVER SCAN receptacle of the Model SCU-7, using the supplied cable, Model 94609-1.

c. Connect the Y OUTPUT receptacle of the EMI/FI Meter to the Y input receptacle of the X-Y plotter, using a BNC to BNC cable, Model 94596-1, or suitable alternate cable.

d. Connect the PEN LIFT receptacle of the Model SCU-7 to the appropriate pen lift connector of the X-Y plotter using the supplied cable, Model 94609-1.

e. Connect the X AXIS OUTPUT receptacle of the Model SCU-7 to the X input receptacle of the X-Y plotter, using a BNC to BNC cable, Model 94596-1, or suitable alternate cable.

f. Connect a signal pick-up device to the EMI/FI Meter RF INPUT receptacle as required.

g. Set the CONTROL MODE switch of the EMI/FI Meter to the SCAN position.

NOTE:

The phone plug in the EXTERNAL SCAN receptacle opens the circuit of the internal scan of the EMI/FI Meter and the Model SCU-7 is then used to control the scan of the EMI/FI Meter.

3.1.3 Spectrum Scan Mode Interconnections

a. Refer to Paragraph 3.1.1 for power connections. Refer also to Figure 3-1.

b. Connect the EXTERNAL SCAN receptacle of the EMI/FI Meter to the RECEIVER SCAN receptacle of the Model SCU-7, using the supplied cable, Model 94609-1.

c. Connect the LOG VIDEO receptacle of the EMI/FI Meter to the Y AXIS BLANKING IN receptacle of the Model SCU-7, using a BNC to BNC cable, Model 94596-1, or suitable alternate cable.

d. Connect the X AXIS OUTPUT receptacle of the Model SCU-7 to the horizontal input receptacle of the oscilloscope, using a BNC to BNC cable, Model 94596-1, or suitable alternate cable.

e. Connect the Y AXIS BLANKING OUT of the Model SCU-7 to the vertical input of the oscilloscope, using a BNC to BNC cable, Model 94596-1, or suitable alternate cable.

f. Connect a signal pick-up device to the EMI/FI Meter RF INPUT receptacle as required.

g. Set the CONTROL MODE switch of the EMI/FI Meter to the SCAN position.

NOTE

The phone plug in the EXTERNAL SCAN receptacle opens the circuit of the internal scan of the EMI/FI Meter and the Model SCU-7 is then used to control the scan of the EMI/FI Meter.

3.1.4 Combined Plot Scan and Spectrum Scan Interconnections

It may be desireable to quickly change from Plot Scan to Spectrum Scan mode. Interconnect all the solid lines displayed in Figure 3-1, using both the X-Y plotter and the oscilloscope. In addition, use a BNC T connector at the juncture of the solid and dotted interconnections and connect both dotted cables to the Model SCU-7 X AXIS output receptacle. The X-Y plotter servo should be switched off when the Model SCU-7 SCAN MODE switch is in the SPECTRUM position.

Section IV

OPERATING INSTRUCTIONS

4.1 GENERAL

Instructions and information for using the Model SCU-7 and a functional description of controls, indicators and receptacles are presented in this section of the manual.

4.2 OPERATING CONTROLS, INDICATORS AND RECEPTACLES

Table 4-1 describes the functions of all controls, indicators and receptacles. Figure 4-1 displays the location of these items.

Table 4-1. Controls, Indicators and Receptacles, Model SCU-7

Item	Panel Marking	Description	Function
1	RATE	Variable resistor (R1)	Controls the rate of EMI/FI Meter scan
2	f_o	10 turn variable resistor (R37)	Controls the center frequency of EMI/FI Meter scan. Center frequency may be positioned at any frequency point in the band being examined.
3	Δf	Rotary switch/variable resistor (S3/R34)	Controls the EMI/FI Meter scan width and may be adjusted from 0% to 100% of the receiver band. Scan width is zero in the OFF (ccw) position for narrowband signal investigation.

Table 4-1. Controls, Indicators and Receptacles, Model SCU-7, Continued

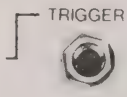
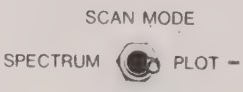
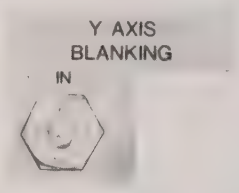
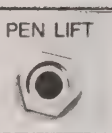
Item	Panel Marking	Description	Function
4		Momentary pushbutton switch (S2)	Used in PLOT position of item 5 to trigger the scan.
5		2-position toggle switch (S1)	Selects the mode of operation, and the scan time range. In the SPECTRUM mode the scan time is approximately 30 ms to 3 s for oscilloscope display. In the PLOT mode the scan time is approximately 15 s to 25 min for use with an X-Y plotter.
6		6 pin connector (J6)	Supplies power to Model SCU-7
7		BNC connector (J2)	Provides scan voltages to EMI/FI Meter
8		BNC connector (J1)	Provides the horizontal input to an oscilloscope in the SPECTRUM mode and the X-axis input to an X-Y plotter in the PLOT mode (0 V to +10 V).
9		BNC connector (J5)	Provides vertical input blanking to an oscilloscope

Table 4-1. Controls, Indicators and Receptacles, Continued

Item	Panel Marking	Description	Function
10		BNC connector (J4)	Provides a log video output from the EMI/FI Meter to the Y-axis blanking circuit.
11		Phone jack (J3)	Provides a pen-lift control to the X-Y plotter.

4.3 OPERATING PROCEDURE

4.3.1 Plot Scan Mode

a. Interconnect the equipment as explained in Paragraphs 3.1.1 and 3.1.2.

b. Set the EMI/FI Meter to the desired frequency band.

c. Set up the X-Y plotter axes for the desired resolution (X-axis output level is 0 V to +10 V, open circuit; Y-axis output level is 0 V to +2 V, open circuit).

NOTE

The PEN LIFT receptacle is connected internally to the switching contacts of a relay which close during the retrace time and have a current rating of 1 ampere peak. If the X-Y plotter used with the Model SCU-7 has a pen lift circuitry of sufficient surge-current demand to damage the switching contacts, it is advisable to add a relay between the PEN LIFT receptacle of the Model SCU-7 and the pen lift receptacle of the X-Y plotter.

d. Set the SCAN MODE switch to the PLOT position.

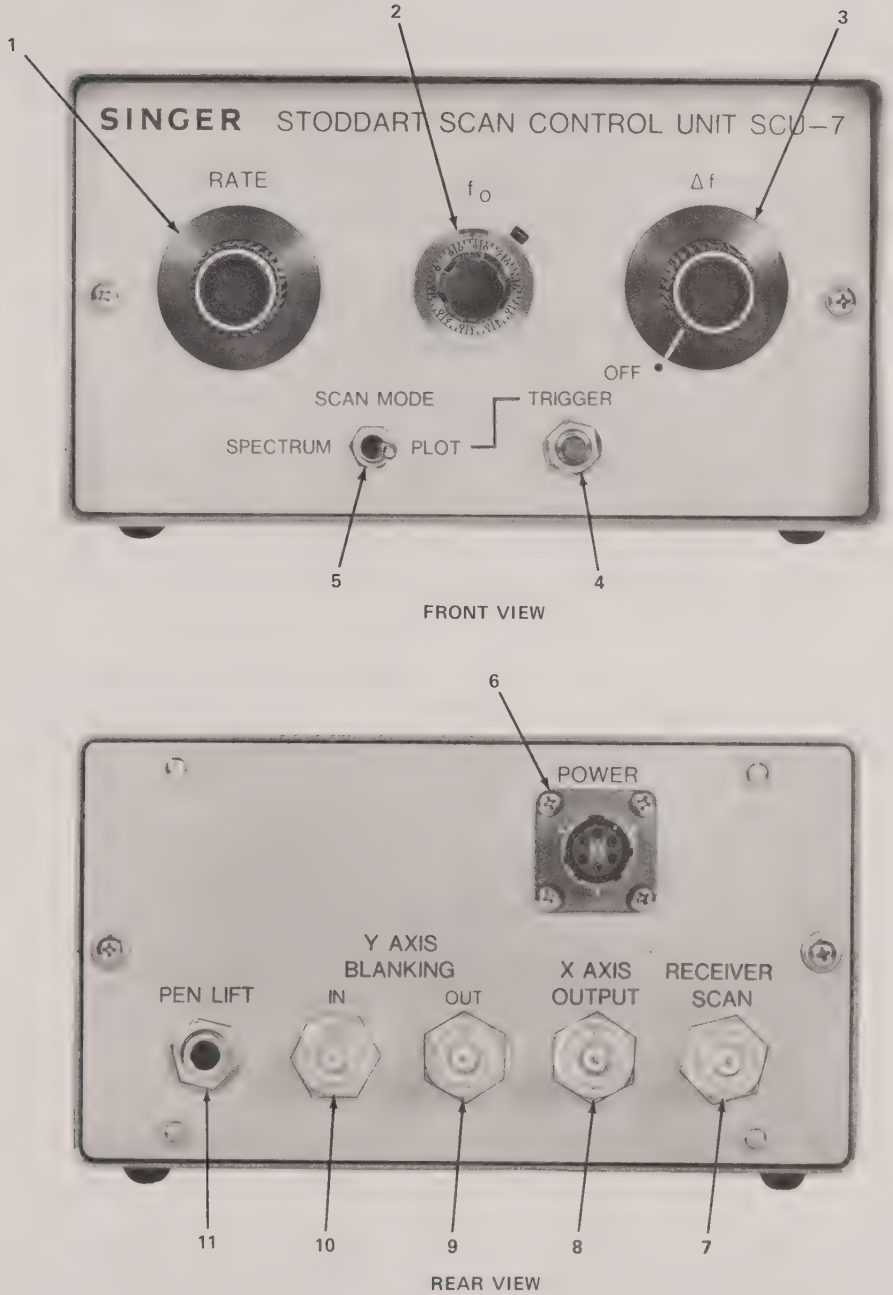


Figure 4-1. Controls, Indicators and Receptacles, Model SCU-7

e. Set the Δf control to the OFF position.

f. Set the fo control to the desired center frequency as indicated by the EMI/FI Meter frequency scale.

g. The frequency scan will be symmetrical above and below fo. Rotate the Δf control clockwise to set the lower limit of the scan width desired as indicated on the EMI/FI Meter frequency scale.

h. Set the RATE control to the desired scan rate (15 seconds to 25 minutes).

i. Depress the TRIGGER switch to initiate the scan. The scan is not repetitive.

j. Manual tuning of the EMI/FI Meter may be accomplished by placing the Δf control in the OFF position and varying the fo control throughout the frequency range of the selected band.

4.3.2 Spectrum Scan Mode

a. Interconnect the equipment as explained in Paragraph 3.1.1 and 3.1.3.

b. Set the EMI/FI Meter to the desired frequency band.

c. Set up the oscilloscope controls for the desired resolution or if a calibrated level is required, see Paragraph 4.3.3.

d. Set the SCAN MODE switch to the SPECTRUM position.

e. Set the Δf control to the OFF position.

f. Set the fo control to the desired center frequency as indicated by the EMI/FI Meter frequency scale.

g. The spectrum scan will be symmetrical above and below fo. Rotate the Δf control clockwise to set the lower limit of the scan width desired as indicated on the EMI/FI Meter frequency scale.

h. Set the RATE control to the desired scan rate (30 ms to 3 seconds). (See also Paragraph 4.3.4 for cautions on resolution distortion.)

i. It is unnecessary to depress the TRIGGER switch, and the scan is repetitive.

j. The signal will be blanked during the retrace time.

k. Manual tuning of the EMI/FI Meter may be accomplished by varying the fo control throughout the frequency range of the selected band with the $\triangle f$ control in the OFF position.

4.3.3 Calibrated Oscilloscope Display

a. Connect a 75 ohm resistor across the Y-AXIS BLANKING IN receptacle. Use a BNC T adapter and a 75 ohm BNC termination.

b. Set the oscilloscope vertical controls to 50 mV per division. (This provides 10 dB/μV per division sensitivity.)

c. Set the $\triangle f$ control to the OFF position.

d. Tune in a CW signal from a signal generator or from a radio station.

e. Note the level on the EMI/FI Meter.

f. Set the vertical position control of the oscilloscope so that the horizontal line displayed on the CRT screen (see Figure 4-1) coincides with the EMI/FI Meter indication.

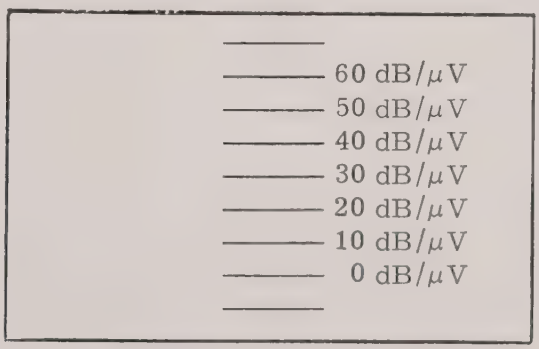


Figure 4-2. Calibrated CRT Graticule

4.3.4 Cautions on Resolution Distortion

Distortion to the spectral display will occur if an incorrect scan time is selected for the EMI/FI Meter bandwidth. Since the signal must exist within the pass-band of the IF amplifier for a sufficient time duration to prevent distortion, the scan time should be slower than the following:

$$T = \frac{D}{B^2}$$

Where T = the scan time per sweep in seconds

D = the frequency dispersion in Hz

B = the IF bandwidth in Hz

The proper scan time may be determined by observing the amplitude of the signal response on the oscilloscope while varying the SCAN RATE control. The amplitude will decrease if the scan rate is excessive.

Another method of checking for the proper scan rate is to change the IF bandwidth. The amplitude will decrease if the bandwidth is insufficient.

Section V

THEORY OF OPERATION

5.1 GENERAL

This section contains the theory of operation of the Model SCU-7. The information is presented in two forms: a discussion of the basic principles of operation using the Simplified Block Diagram, Figure 5-1, and a detailed circuit analysis which is oriented to the Schematic Diagram, Figure 8-1, and the Detailed Block Diagram, Figure 8-2. The information is presented to give the user an understanding of its operation and assist in the alignment and troubleshooting of the instrument.

5.2 BASIC PRINCIPLES OF OPERATION

The Model SCU-7 is basically an auxiliary device to be used with one of the EMI/FI Meters, Models NM-7, NM-17/27, and NM-37/57. It is designed to extend the electronic sweep function of the receiver. The center frequency, width and rate of the scan can be varied which allows a more extensive examination of a signal within the frequency range of the receiver. The provision for a choice of readouts allows either an oscilloscope display or an X-Y plotter recording.

5.3 DETAILED CIRCUIT ANALYSIS

5.3.1 Ramp Generation Circuitry

The integrator, A1U1, generates the initial ramp voltage used for scanning the receiver. At this time reset switch, A1Q1, is open and the output of A1U1 is a

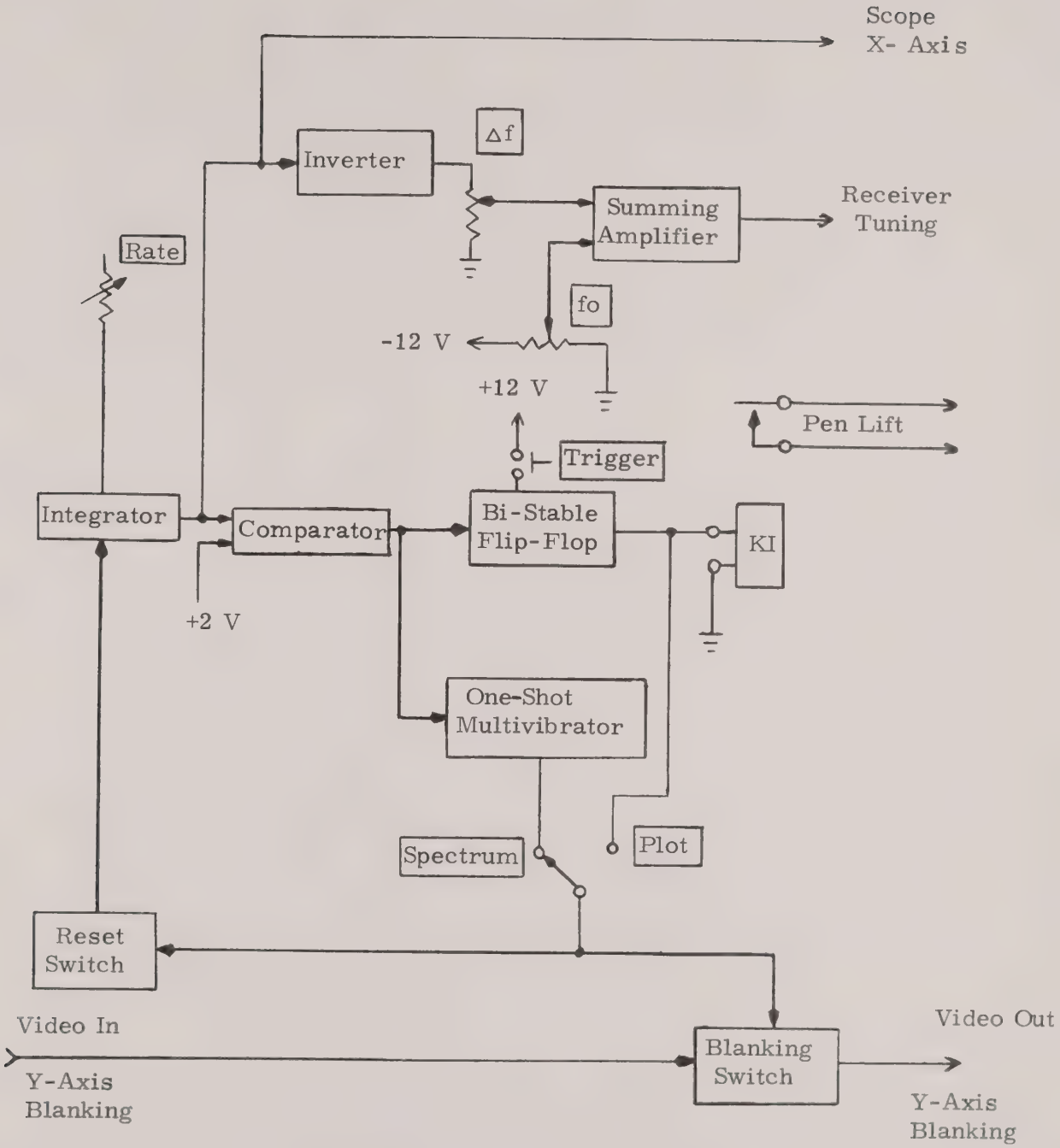


Figure 5-1. Simplified Block Diagram, Model SCU-7

positive-going ramp with an amplitude of 2 volts. Its rate is determined by the voltage at the wiper of the RATE control, R1, the values of A1R3, A1C2, A1C3 and the position of the SCAN MODE switch, S1A. The amplitude of the ramp is determined by the reference input (2 volts) to the comparator, A1U2. When the comparator switches, a positive pulse occurs which ends the ramp by turning on (closing) the reset switch, A1Q1.

When operating in the SPECTRUM mode, the one-shot multivibrator, A1U3, produces a 22 V, 4 ms positive pulse (-11 V to +11 V) which closes the reset switch, A1Q1, and short circuits A1C2 causing the ramp voltage to return abruptly to zero. This condition continues for 4 ms (the width of the positive pulse at the output of A1U3) to cause a 4 ms dwell between ramps. When the output of A1U3 returns to -11 volts, the reset switch, A1Q1, is opened and the next ramp voltage is enabled to repeat the cycle. In the SPECTRUM mode, the scan rate is determined by the value of A1C2 and A1R3 and the position of the wiper of the RATE control, R1. The scan rate in this mode has a range from approximately 0. 3 to 33 sweeps per second necessary for a spectral display on an oscilloscope.

When operating in the PLOT mode, the flip-flop, A1U4, allows a single ramp to be generated. The quiescent state at the output of A1U4 is +11 volts which closes the reset switch, A1Q1, and the output of integrator, A1U1, will remain at zero volts. When the TRIGGER switch, S2, is closed, the output of the flip-flop, A1U4, changes polarity and causes the reset switch, A1Q1, to open and start the ramp.

When the ramp is completed (when the output of A1U1 reaches +2 V) the comparator, A1U2, changes state and triggers the flip-flop multivibrator, A1U4, to its alternate condition (quiescent state). The system will remain in this condition until the TRIGGER switch, S2, is closed again and the cycle repeated. In the PLOT mode, the capacitor A1C3 is added in parallel to A1C2. It takes a longer time to charge the added capacitance and a slower range of scan rates is produced at the output of A1U1. The scan rate in this mode has a range from approximately 15 s to 25 min and is suitable for operation of an X-Y plotter.

5.3.2 X- Axis Circuitry

The 0 V to +2 V ramp at the output of A1U1 is amplified by A1U5 to produce a 0 V to +10 V ramp which is routed to the X-AXIS OUTPUT receptacle, J1, to operate an oscilloscope or X-Y plotter X-axis. The amplified output is also inverted by A1U6 and produces a ramp voltage which varies from +5 V to -5 V. Any portion of this voltage swing, centered about zero volts, can be selected by the wiper of the $\triangle$f control, R34, and is applied to the summing amplifier, A1U7. The dc voltage at the wiper of the f_o control, R37, is also applied to the summing amplifier, A1U7. The output of A1U7 becomes the receiver scan voltage. Figure 8-2 displays the waveform at the A1U7 output when the $\triangle$f control is at the electrical mid-position and the f_o control is at 500. In this case, the scan range voltages are varying from +2. 5 V to +7. 5 V with a center frequency corresponding to +5 V. This provides the receiver scan voltage which is synchronized with the X-axis sweep voltage.

5.3.3 Y-Axis Circuitry

When operating in the SPECTRUM mode, the positive voltage which appears at A1Q1 to close the switch during the dwell period also is inverted by A1Q2 and appears at the blanking switch, A1Q3, as a negative pulse. This will open the switch and turn off the Y-axis data during the retrace time and when a ramp is not being generated.

When operating in the PLOT mode, the blanking switch, A1Q3, operates as in the SPECTRUM mode to provide Y-data blanking during retrace time. The negative voltage applied from A1U4 will close the blanking switch, A1Q3, as the reset switch, A1Q1, is opened, during which time the ramp is generated and the Y-data is transmitted. When the A1U4 output becomes positive (quiescent state) the blanking switch, A1Q3, opens as the reset switch, A1Q1, is closed and Y-data cannot be transmitted during the retrace time. In the PLOT mode during the quiescent state, the output of A1U4 is +11 volts. No voltage will be applied to A1K1 due to A1CR4 and the pen lift relay contacts will remain open. When the TRIGGER switch, S2, is closed, the A1U4 output changes polarity and the ramp is started. During this period, -11 V will be applied to A1K1L1 and the pen lift relay contacts will close.

Section VI

MAINTENANCE

6.1 INTRODUCTION

This section of the manual contains minimum performance procedures, disassembly procedures, alignment procedures and fault isolation procedures for the Model SCU-7. The minimum performance test procedures are intended to verify that the Model SCU-7 is functioning in accordance with the specifications and operating characteristics listed in Section II. Disassembly procedures are presented as necessary for alignment of the instrument. No scheduled, periodic maintenance of the Model SCU-7 is required. The minimum performance test procedures should be used to establish the operational performance capability of the instrument, and the fault isolation procedure should be used to assist in isolating a possible malfunction to a specific section. Use normal troubleshooting techniques to further isolate the fault to the component level. Replace the faulty component, then test and realign the unit as necessary.

6.2 MINIMUM PERFORMANCE PROCEDURES

The procedures contained in this section may be used to establish the performance of the Model SCU-7 within acceptable limits.

6.2.1 Test Equipment Required

Table 6-1 lists the test equipment minimum parameters and recommended models that are required for conducting the minimum performance procedures of the Model SCU-7.

Table 6-1. Test Equipment Requirements for Minimum Performance Tests

Instrument	Minimum Parameters	Recommended Model
Digital dc voltmeter	Measurement range: 0V to +12.000 V Accuracy: ±0.005 V	Hewlett-Packard 3440A
Oscilloscope	Frequency response: 1 kHz Level: ± 11 V	Tektronix 535A
Audio oscillator	Frequency range: 50 Hz to 1 kHz Output level: 2 V p-p	Hewlett-Packard 200 CD
Dc power supply	Output level: ±12 V at 50 mA Regulation: ± 0.04%	Harrison 6205-B
Ohmmeter	Measurement range: short-circuit and open-circuit	Simpson 260

6.2.2 To Evaluate X- Axis Output Waveform

a. Set the RATE control fully cw and set the SCAN MODE switch to the SPECTRUM position.

b. Connect the oscilloscope vertical input receptacle to the X AXIS OUTPUT receptacle.

c. The oscilloscope should indicate a positive-going ramp from zero to +10.0 V ±0.50 V (+9.5 V to +10.5 V). The duration of the ramp should be less than 30 milliseconds. A zero volt dwell period of approximately 4 milliseconds should appear prior to the beginning of the ramp.

d. Rotate the RATE control fully ccw. The ramp duration should increase to greater than 3 seconds.

e. Return the RATE control fully cw. Set the SCAN MODE switch to the PLOT position. The X-Axis output level displayed on the oscilloscope should be 0 V ± 0.1 V (-0.1 V to +0.1 V).

e. Check the operation of the fo control by rotating it throughout its full range and verify that the RECEIVER SCAN output voltage varies from 0.0 V to +10.0 V and agrees within ±0.2 V of the dial indication divided by 100.

6.2.5 To Evaluate the Operation of the Pen Lift Circuit

a. Set the SCAN MODE switch to the PLOT position.

b. Connect an ohmmeter across the PEN LIFT receptacle non-grounded terminals. The circuit should be open.

c. Depress the TRIGGER switch. The circuit should close during the ramp period and open again as the ramp returns to zero.

6.2.6 To Evaluate the Operation of the Y-Axis Blanking Circuit

a. Connect the audio oscillator output receptacle to the Y AXIS BLANKING IN receptacle.

b. Adjust the audio oscillator for an output level of 2 V peak-to-peak open circuit at a frequency of 1 kHz.

c. Connect the oscilloscope vertical input receptacle to the Y AXIS BLANKING OUT receptacle.

d. Depress the TRIGGER switch. The 1 kHz waveform should indicate approximately 2 V peak-to-peak on the oscilloscope during the ramp period and drop to zero as the ramp returns to zero.

6.3 ALIGNMENT AND ADJUSTMENT PROCEDURES

6.3.1 Disassembly Procedures

The removal of two front panel screws and two corresponding rear panel screws

(do not remove the 4 center screws) allows removal of the PC board assembly and provides access necessary for adjustments and alignment. Refer to Figure 6-1 for the location of the adjustment points on the PC board assembly. Table 6-1 lists the test equipment necessary for the alignment and adjustment of the Model SCU-7.

6.3.2 Receiver Scan Alignment

a. Connect the power supply to the Model SCU-7 as follows: +12 V to J6-F, -12 V to J6-B, Common to J6-D. Connect the digital dc voltmeter to the RECEIVER SCAN receptacle, J2. Set the Model SCU-7 controls as follows:

SCAN MODE	SPECTRUM
Δ f	fully ccw to OFF
fo	1000

b. Adjust A1R35 to obtain an output level of +10.000 V ±0.01 V (+9.99 V to +10.01 V).

c. Set the CONTROL MODE switch to the PLOT position, set the Δf control fully cw, and set the fo control to 500.

d. Adjust A1R32 to obtain an output level of 0.000 V ±0.010 V (-0.010 V to +0.010 V).

e. Set the CONTROL MODE switch to the SPECTRUM position and set the RATE control fully clockwise. Connect the oscilloscope to the RECEIVER SCAN receptacle, J2. Set the oscilloscope to dc vertical input coupling.

f. Adjust A1R27 to obtain a positive-going ramp from 0.0 V to +10.05 V ±0.05 V (+10.00 V to +10.10 V).

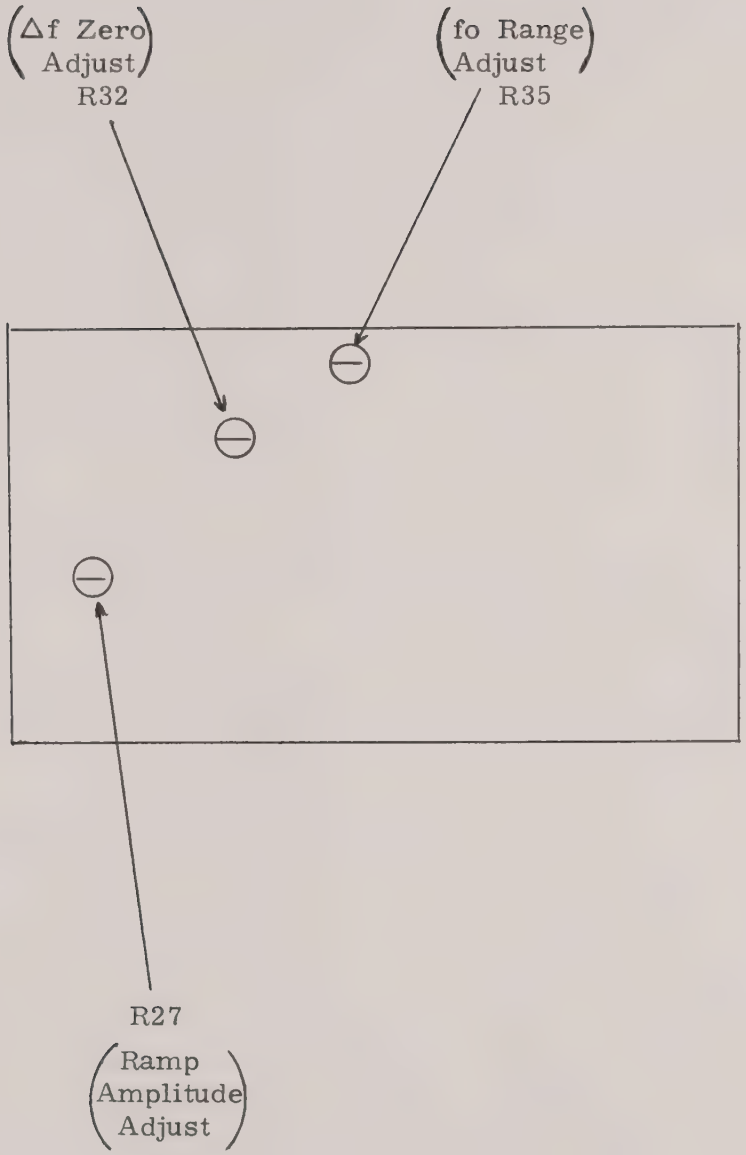


Figure 6-1. Trimmer Locations, PC Board Assembly, A1

6.4 FAULT ISOLATION PROCEDURE

Fault isolation procedures are presented as a guide in troubleshotting the Model SCU-7.

6.4.1 X-Axis Output Defective

a. Check ramp generation circuitry, A1U6, A1U2, A1U3, A1U4, and A1Q1.

b. Check amplifier A1U5.

6.4.2 Receiver Scan Output Defective

a. Check A1U6 and A1U7.

6.4.3 Pen Lift Defective

a. Check relay, A1K1 and diode, A1CR4.

6.4.4 Y-Axis Blanking Defective

a. Check inverter, A1Q2.

b. Check blanking switch, A1Q3.

Section VII

REPLACEABLE PARTS

7.1 INTRODUCTION

This section contains information for ordering replacement parts. Table 7-1 lists the parts for the Main Assembly and Chassis; Table 7-2 lists the Supplied Accessories, and Table 7-3 lists the parts of the PC Board Assembly, A1. Parts are listed in alpha-numerical order of their reference designators and indicate the description, the Singer part number, the typical manufacturer of the part in a five-digit code and the manufacturer's part number. Table 7-4 lists the typical manufacturers in numerical code number order.

Table 7-1. Parts List for Main Assembly and Chassis Parts, Model SCU-7

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
A1	Board, P.C. assembly	1-004847-001	88869	
J1	Connector, jack, BNC	1-910132-002	11636	UG-1094/U
J2	Connector, jack, BNC	1-910132-002	11636	UG-1094/U
J3	Connector, jack, phone	1-910152-001	82389	S-13B
J4	Connector, jack, BNC	1-910132-002	11636	UG-1094/U
J5	Connector, jack, BNC	1-910132-002	11636	UG-1094/U
J6	Connector jack, 6 pins	1-910206-001	71468	KPSE02E 10-6S
R1	Resistor, variable, composition, 10 kilohm, ±30%, 1/2W	1-403607-001	71450	45-2D
R2 thru R33	Not Used			
R34	Resistor, variable, composition, 1/2W, 10 kilohm, ±30% (part of S3/R34)	1-403606-001	71450	VF-45-4D
R35 thru R36	Not Used			
R37	Resistor, variable, wirewound, 10 kilohm, ±3%, 1.5 W	1-945102-002	80740	7216R-10K L. 25
S1	Switch, toggle, DPDT	1-951036-007	09353	7203 HWBE
S2	Switch, pushbutton, momentary	1-951035-001	82389	923
S3/R34	Switch/variable resistor assembly, (S3) Switch, rotary, SPDT	1-403606	88869	

Table 7-2. Supplied Accessories Parts List, Model SCU-7

Qty	Description	Singer Part No./ Model No.	Mfr. Code No.	Mfr. Part No.
1	Instruction Manual	1-500783-268	88869	
1	Power Cable, 6 ft., 6 pin to 6 pin	1-004862-001	88869	
1	Scan Cable, 6 ft., BNC to phone plug	94609-1	88869	
1	Pen lift cable, 6 ft., BNC to phone plug, 2 circuit	94610-1	88869	

Table 7-3. Parts List for PC Board Assembly, A1

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
C1	Capacitor, fixed, mica, 30 pF, ±5%, 500 Vdc	1-900003-016	72136	DM15
C2	Capacitor, fixed, plastic, 0.1 uF, ±10%, 250 Vdc	1-900001-113	73445	C280AE
C3	Capacitor, fixed, electrolytic, 47 uF, ±10%, 20 Vdc	1-900057-127	56289	150D476X 902R22
C4	Capacitor, fixed, plastic, 0.1 uF, ±10%, 250 Vdc	1-900001-113	73445	C280AE
C5	Capacitor, fixed, electrolytic, 1 uF, ±20%, 35 Vdc	1-900057-146	56289	150D105X 0035A22
C6	Capacitor, fixed, plastic, 0.01 uF, ±20%, 250 Vdc	1-900001-001	73445	C280AE
C7	Capacitor, fixed, electrolytic, 50uF, -10% +75%, 25 Vdc	1-900039-005	76433	984-1654
C8	Capacitor, fixed, electrolytic, 50 uF, -10% +75%, 25 Vdc	1-900039-005	76433	984-1654
C9	Capacitor, fixed, ceramic, 0.005 uF, ±20%, 100 Vdc	1-900077-001	56289	TG-D50
CR1	Diode, signal, silicon, PRV = 75V If = 10 mA	1-913007-001	03508	1N4148
CR2	Diode, signal, silicon, PRV = 75V If = 10 mA	1-913007-001	03508	1N4148
CR3	Diode, signal, silicon, PRV = 75V If = 10 mA	1-913007-001	03508	1N4148
CR4	Diode, signal, silicon, PRV = 75V If = 10 mA	1-913007-001	03508	1N4148
CR5	Diode, signal, silicon, PRV = 75V If = 10 mA	1-913007-001	03508	1N4148

Table 7-3. Parts List for PC Board Assembly, A1

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
K1	Relay, reed, SPST; coil: 12 Vdc, 500 mA, 1000 ohm	1-942014-004	0000G	1A12AH
Q1	Transistor, N-channel, J-FET, 2N5458	1-958002-002	04713	2N5458
Q2	Transistor, silicon, NPN, 2N3904	1-958000-001	04713	2N3904-5
Q3	Transistor, N-channel, J-FET, 2N5458	1-958002-002	04713	2N5458
R1	Not Used			
R2	Resistor, fixed, composition, 33 ohm, ±5%, 1/4W	1-945000-126	01121	CB3305
R3	Resistor, fixed, composition, 1.5 megohm, ±5%, 1/4W	1-945000-238	01121	CB1555
R4	Resistor, fixed, composition, 1.5 kilohm, ±5%, 1/4W	1-945000-166	01121	CB1525
R5	Resistor, fixed, composition, 47 kilohm, ±5%, 1/4W	1-945000-202	01121	CB4735
R6	Resistor, fixed, composition, 10 kilohm, ±5%, 1/4W	1-945000-186	01121	CB1035
R7	Resistor, fixed, film, 49.9 kilohm, ±1%, 1/4W	1-945027-356	07115	NA55D
R8	Resistor, fixed, film, 10 kilohm, ±1%, 1/4W	1-945027-289	07115	NA55D
R9	Resistor, fixed, composition, 68 kilohm, ±5%, 1/4W	1-945000-206	01121	CB6835
R10	Resistor, fixed, composition, 1.5 kilohm, ±5%, 1/4W	1-945000-166	01121	CB1525

Table 7-3. Parts List for PC Board Assembly, A1

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
R11	Resistor, fixed, composition, 47 kilohm, ±5%, 1/4W	1-945000-202	01121	CB4735
R12	Resistor, fixed, composition, 470 kilohm, ±5%, 1/4W	1-945000-226	01121	CB4745
R13	Resistor, fixed, composition, 47 kilohm, ±5%, 1/4W	1-945000-202	01121	CB4735
R14	Resistor, fixed, composition, 47 kilohm, ±5%, 1/4W	1-945000-202	01121	CB4735
R15	Resistor, fixed, composition, 470 kilohm, ±5%, 1/4W	1-945000-226	01121	CB4745
R16	Resistor, fixed, composition, 470 kilohm, ±5%, 1/4W	1-945000-226	01121	CB4745
R17	Resistor, fixed, composition, 470 kilohm, ±5%, 1/4W	1-945000-226	01121	CB4745
R18	Resistor, fixed, composition, 68 kilohm, ±5%, 1/4W	1-945000-206	01121	CB6835
R19	Resistor, fixed, composition, 10 kilohm, ±5%, 1/4W	1-945000-186	01121	CB1035
R20	Resistor, fixed, composition, 10 kilohm, ±5%, 1/4W	1-945000-186	01121	CB1035
R21	Resistor, fixed, composition, 10 kilohm, ±5%, 1/4W	1-945000-186	01121	CB1035
R22	Resistor, fixed, composition, 33 kilohm, ±5%, 1/4W	1-945000-198	01121	CB3335
R23	Resistor, fixed, composition, 33 kilohm, ±5%, 1/4W	1-945000-198	01121	CB 3335
R24	Resistor, fixed, composition, 10 kilohm, ±5%, 1/4W	1-945000-186	01121	CB1035

Table 7-3. Parts List for PC Board Assembly, A1

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
R25	Resistor, fixed, composition, 10 kilohm, ±5%, 1/4W	1-945000-186	01121	CB1035
R26	Resistor, fixed, composition, 33 kilohm, ±5%, 1/4W	1-945000-198	01121	CB3335
R27	Resistor, variable, cermet, 20 kilohm, ±10%, 1/2W	1-945037-011	80740	62PR20K
R28	Resistor, fixed, composition, 1.5 kilohm, ±5%, 1/4W	1-945000-166	01121	CB1525
R29	Resistor, fixed, composition, 47 kilohm, ±5%, 1/4W	1-945000-202	01121	CB4735
R30	Resistor, fixed, film, 100 kilohm, ±1%, 1/4W	1-945027-385	07115	NA55D
R31	Resistor, fixed, composition, 220 kilohm, ±5%, 1/4W	1-945000-218	01121	CB2245
R32	Resistor, variable, cermet, 50 kilohm, ±10%, 1/2W	1-945037-013	80740	62PR50K
R33	Resistor, fixed, film, 100 kilohm, ±1%, 1/4W	1-945027-385	07115	NA55D
R34	Not Used			
R35	Resistor, variable, cermet, 1 kilohm, ±10%, 1/2W	1-945037-007	80740	62PR1K
R36	Resistor, fixed, composition, 1.5 kilohm, ±5%, 1/4W	1-945000-166	01121	CB1525
R37	Not Used			
R38	Resistor, fixed, film, 100 kilohm, ±1%, 1/4W	1-945027-385	07115	NA55D

Table 7-3. Parts List for PC Board Assembly, A1

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
R39	Resistor, fixed, film, 100 kilohm, ±1%, 1/4W	1-945027-385	07115	NA55D
R40	Resistor, fixed, composition, 33 kilohm, ±5%, 1/4W	1-945000-198	01121	CB3335
R41	Resistor, fixed, film, 100 kilohm, ±1%, 1/4W	1-945027-385	07115	NA55D
U1	Integrated circuit, operational amplifier	1-926069-001	27014	LM308H
U2	Integrated circuit, operational amplifier	1-926070-001	07263	709HC
U3	Integrated circuit, operational amplifier	1-926070-001	07263	709HC
U4	Integrated circuit, operational amplifier	1-926070-001	07263	709HC
U5	Integrated circuit, operational amplifier	1-926036-002	07263	U5B7741 3933
U6	Integrated circuit, operational amplifier	1-926036-002	07263	U5B7741 3933
U7	Integrated circuit, operational amplifier	1-926036-002	07263	U5B7741 3933

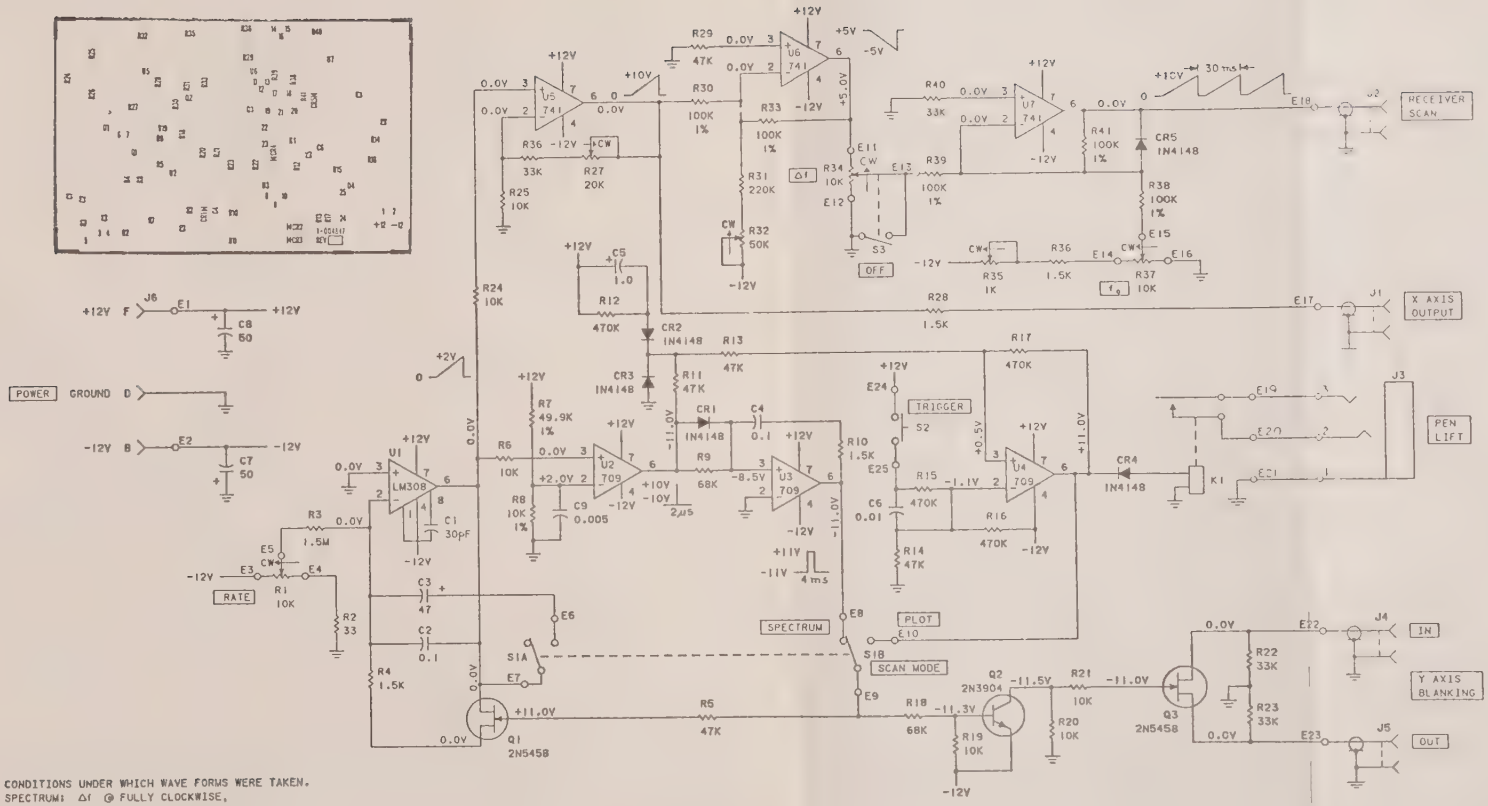
Table 7-4 Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbook H4-2.

Mfg Code No.	Manufacturer	Address
01121	Allen-Bradley Co.	Milwaukee, Wis.
03508	G. E. Semiconductor Prod. Div.	Syracuse, N. Y.
04713	Motorola Inc.	Phoenix, Ariz.
07115	Corning Glass Works, Electronic Components Dept.	Bradford, Pa.
07263	Fairchild Semiconductor Corp.	Mountain View, Calif.
09353	C & K Components Inc.	Newton, Mass.
11636	Kings Electronics Co.	So. Pasadena, Calif.
27014	National Semiconductor Corp.	Santa Clara, Calif.
56289	Sprague Electric Co.	North Adams, Mass.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric	Santa Ana, Calif.
72136	Electro Motive Mfg. Co.	Willimantic, Conn.
73445	Amperex Electronics Co.	Hicksville, N. Y.
76433	General Instrument Co.	Newark, N. J.
80740	Helipot Div. of Beckman Industries	Fullerton, Calif.
82389	Switchcraft	Chicago, Ill.
88869	Singer Instrumentation	Los Angeles, Calif.

The following vendor has no number assigned in the latest supplement to the Federal Supply Code for Manufacturers H4-2.

Mfg Code No.	Manufacturer	Address
0000G	Electronic Application	So. El Monte, Calif.



6. CONDITIONS UNDER WHICH WAVE FORMS WERE TAKEN.
   SPECTRUM: Δf @ FULLY CLOCKWISE,
   f_o @ 500,
   RATE @ FULLY CLOCKWISE.
5. CONDITIONS UNDER WHICH DC VOLTAGES WERE TAKEN.
   PLOT: Δf @ FULLY CLOCKWISE,
   f_o @ 500,
   RATE @ FULLY CLOCKWISE.
4. BOXED WORDING INDICATES PANEL NOMENCLATURE AND CONTROLS.
3. S3 CLOSES WHEN R34 IS FULLY COUNTER CLOCKWISE.
2. CAPACITANCE VALUES ARE IN MICROFARADS.
1. RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4W.

REFERENCE DESIGNATION BLOCK	
LAST NO. USED	NO. NOT USED
C9	
CR5	
J6	
K1	
Q3	
R41	
S3	
U7	

Figure 8-1. Schematic Diagram, Scan Control Unit, Model SCU-7. Dwg. No. 4-501346-001

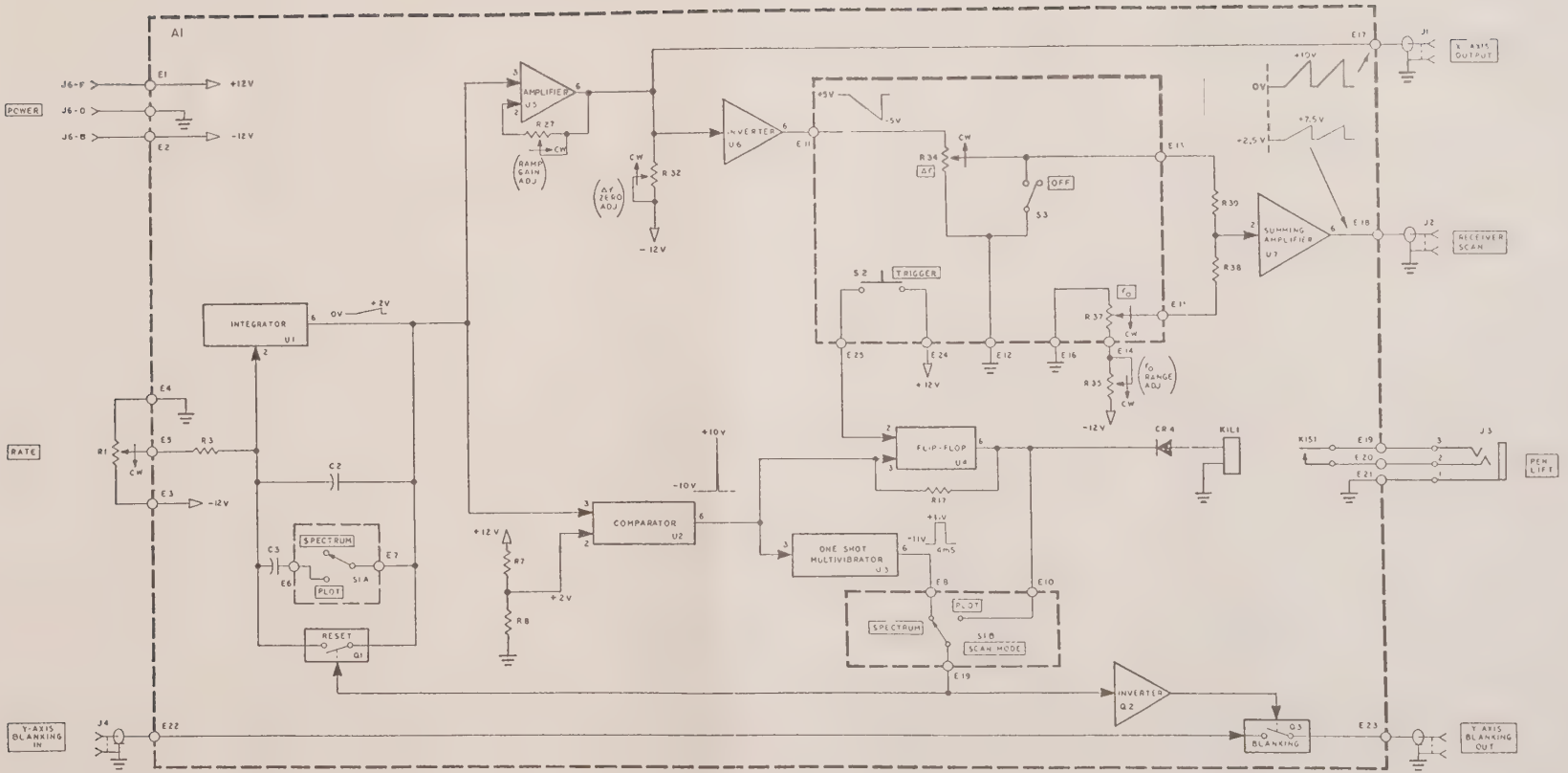


Figure 8-2. Detailed Block Diagram, Model SCU-7. Dwg. No. 4-501359-001

3. CONDITIONS UNDER WHICH DC VOLTAGES WERE TAKEN.
   PLOT: Δf @ FULLY CLOCKWISE,
   f_o @ 500,
   RATE @ FULLY CLOCKWISE.
2. BOXED WORDING INDICATES PANEL NOMENCLATURE AND CONTROLS.

1. CONDITIONS UNDER WHICH WAVEFORMS WERE TAKEN..
   SPECTRUM: Δf @ MID POSITION (ELECTRICAL)
   f_o @ 500,
   RATE @ FULLY CLOCKWISE.

NOTES: UNLESS OTHERWISE SPECIFIED

ADDENDUM
For
Manual No. 1-500783-268 (Rev. A)
Model SCU-7

RUNNING CHANGES

Perform the following changes to the above manual.

Effective serial number: Serial numbers prefixed with 102 and above

Page 7-8: Table 7-3. Parts List for PC Board Assembly, A1

U2, Was:	Integrated circuit, operational amplifier	1-926070-001	07263	709HC
Is:	Integrated circuit, operational amplifier	1-926036-002	07263	U5B774-1393

Page 8-1/8-2: Figure 8-1. Schematic Diagram, Scan Control Unit, Model SCU-7
U2, Was: 709 Is: 741

Effective serial number: Serial numbers suffixed with 04078 and above.

Page 7-2: Table 7-1. Parts List for Main Assemblies and Chassis Parts, Model SCU-7.
S1, Singer Part No. and Mfr. Part No., Was: 1-951036-007 and 7203-HWBE
Is: 1-951036-006 and 7201-HWBE

REVISED (A) B. Myers 1-9-75
APPROVED B. Ayers 1-10-74

The Singer Company, Los Angeles Operation 3211 South La Cienega Blvd., Los Angeles, Ca. 90016	TITLE ADDENDUM MODEL SCU-7	DWG NO. I- 500783-268(A) SHEET 2 of 1

FORM NO. 160 1M 3-70 D-H

NOTES

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UNITED KINGDOM • CROWTHORNE • TELEPHONE 5777 • TELEX 851-847238
GERMANY • MUNICH • TELEPHONE: (089) 5233023 • TELEX 841-529420
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